however, is even wider in its scope than the "**Natural History of Creation.**" The opening lectures are devoted to a historical account of the various hypotheses which have been formulated regarding man's origin and evolution, and to the bearing of Darwin's work on the modern problems of anthropology. The following chapters have even a wider sweep; they deal with life, the conditions of life, as far back in the world's history as human imagination can reach. Embryology, growth, anatomy, and all the various kinds of knowledge which have even a remote bearing on the human body are woven into the subject-matter of Prof. Morselli's lectures.

The chapters dealing with extinct and past forms of men are very complete. One is rather surprised to observe that he accepts in good faith all the discoveries of ancient man which have been made in South America in recent years. The concluding lecture pictures the man of the future as a form of Greek god. The numerous illustrations, although they have often little connection with the part of the text in which they appear, are well executed, and have been selected from many standard works and original papers.

The work is so ambitious in aim and so wide in its scope that it is impossible for any single man to obtain a first-hand knowledge of all its parts; few could have completed so successfully the task which Prof. Morselli imposed on himself.

An Outline of the Russo-Japanese War, 1904, 1905. By Col. Charles Ross, D.S.O. Vol. i., Up to, and including, the Battle of Liao-Yang. Pp. xxv+490+14 maps. (London: Macmillan and Co., Ltd., 1912.) Price 10*s*. 6*d*. net. (Military Text-Books.)

This account of the latest of the great campaigns of modern history takes the story up to the close of the first stage of the Japanese advance into Manchuria, which was marked by the complete and final severance of the field army under Kuropatkin from the troops interned in Port Arthur.

Naturally in so comparatively short a work it has been impossible for the author to enter into any discussion of tactical problems or to refer to the doings of the smaller units, whether in action or during the various strategical movements of the campaign. He has succeeded, however, in giving a very clear view of the earlier phases of the war, and of the numerous influences that guided the actions of the opposing commanders.

The chapters dealing with the war itself are exceedingly clearly written, and the contrast between the divided counsels that confused the Russian strategy and the impassive unanimity that ruled the movements of the Japanese is well brought out. As one would expect from an author bearing the name of Ross, not only are the facts clearly stated but the lessons to be learnt from them are philosophically discussed. The book should be read by all who desire to get a clear view of the campaign, unencumbered by technical detail, or to realise the effect on the art of war of modern scentific advances.

C. H. M.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* Nature. *No notice is taken of anonymous communications.*]

Practical Mathematics.

It is surely rather a pity that Prof. Perry concluded his letter with such a violent attack on the "professional mathematician." If he had attached a little less importance to Sir William White's address and a little more importance to the proceedings of, and reports presented to, the Educational Section of the Congress, I think he would find ample justification for withdrawing, or at least qualifying, his statement that the teacher "never studies his pupil," or that "the poor average English boy is never studied by the professional mathematician."

One of the main changes that is taking place at the present time consists in the introduction of the calculus at a much earlier stage in our mathematical curricula than was ever dreamt of fifteen years ago. Surely this and many other equally important changes owe their inception largely to what has often been described as the "Perry movement." After all, only a small percentage of the boys who study mathematics at school intend to qualify for the engineering profession. It is in connection with the education of the large body of pupils who learn mathematics as part of a general education that the introduction of the practical element is producing the most beneficial results.

G. H. Bryan.

Weather and the Ultra-violet Radiations of the Sun.

I was rather astonished by Dr. Carl Ramsauer's second letter in Nature of June 13, which has just reached me, and although "the weather of 1911" is rapidly becoming ancient history, and I have much reluctance in pursuing the discussion of it, it is hoped that the long distance which separates me from the editorial room will be sufficient apology for asking your indulgence at this late day in order to register a protest against the conclusions enunciated in that letter.

I regret having to acknowledge that, to me, the letter appears of the nature of a *lucus a non lucendo.* If Dr. Ramsauer advances as a theory, well substantiated by experiment, that ultra-violet solar radiation is the chief source of condensation nuclei in the atmosphere, and cites in support of his theory diminished ultra-violet radiation and a hot and dry summer, with clear skies, in the northern hemisphere during 1911; and if, upon learning that, simultaneously with the existence of drought conditions in the north, there was excessive precipitation in the southern hemisphere, he can conclude that his theory is thereby fortified, in fact, universally confirmed, then he surely owes it to science to support this conclusion by convincing evidence. This should be something more than a mere supposition that the aqueous vapour which diffused into the hot summer atmosphere of the north, not encountering in the free air proper vehicles (provided by solar ultraviolet waves) for returning to the earth's surface, thereupon rushed to the southern hemisphere, where, in lieu of condensation nuclei provided by solar ultraviolet waves, it was pleased to avail itself of the facilities afforded by the ordinary laws governing gaseous bodies in order to get back to *terra firma.* According to what Dr. Shaw has written, it is evident that the laws of gases operated with full vigour in the northern hemisphere during the summer of 1911.

If, as Dr. Ramsauer contends, ultra-violet solar radiation is the *chief source* of condensation nuclei, and if normal ultra-violet radiation is a necessary condition for normal precipitation of aqueous vapour from the atmosphere, and if during periods of diminished activity in this part of the solar spectrum we are to expect the heaviest precipitation over one-half of the world, then it logically follows that the existence *in excess* of condensation nuclei produced by ultra-violet solar rays is a preventive of rain.

Not to pursue farther for the moment this function of ultra-violet radiation, it may be confidently stated that orthodox meteorologists will view with suspicion the simple conception of rapid and general distribution of vapour through the atmosphere embraced in Dr. Ramsauer's supposition. According to a well-established law of physics, the quantity of vapour which may exist in a given space is conditioned upon the temperature of the vapour and the pressure exerted upon it; consequently, in speaking of the aqueous vapour of the atmosphere, it may be said, without widely deviating from the truth, that the temperature of a given volume of air is the controlling factor determining the quantity of vapour which may exist therein. It has been well established by observation that the spontaneous diffusion of vapour in the air is a rather slow process, and that its general distribution through the atmosphere is chiefly effected by the winds and the currents of the general planetary circulation.

Dr. Ramsauer suggests no explanation as to the manner in which the vapour from the northern was translated to the southern hemisphere. The assumption that it was by the process of diffusion implies supersaturation in the upper air; and as to that condition we must hold, with Dr. Shaw, "that it has never been demonstrated." Numerous observations in the lofty atmosphere made in practically all parts of the world, by means of balloons and kites, show that the quantity of vapour decreases in nearly a geometrical progression as the elevation above the surface increases arithmetically, so that even at a moderate height a region is reached in which the water equivalent of its vapour content may conveniently be expressed in barrels instead of billions of tons—a quantity inadequate to account for excessive rains over a large portion of the earth. With such free distribution of vapour in the atmosphere as Dr. Ramsauer suggests, it would be difficult to account for the arid regions of the earth; since atmospheric overturnings are most frequent and most violent over such regions, enough vapour would be condensed to convert them into fertile regions. Indeed, the arid regions furnish evidence of the most conclusive kind that the lowest stratum of the atmosphere constitutes the "physical laboratory where rains and dense clouds are made," since they are all flanked to windward by mountain barriers which abstract the life-giving vapour from the air.

It is highly probable that during the earth's dawn the vapour of the atmosphere was saturated, as it is supposed to be now on Venus, but the irregularities introduced by continental unheavals have been the means of draining the moisture to such an extent that the air over all continental interiors and in all regions high aloft is now prevailingly dry.

If it be assumed that a mere preponderance of vapour over a given region would cause a rapid outflow to regions where the air is less charged, then there might arise a number of complicated conditions much more difficult to explain than the "weather of 1911." For instance, to cite an extreme case, the mean vapour tension over the desert of Sahara is about the same as that over central Europe and southern England; consequently it must be in excess over the desert during probably half the time, and it might therefore be concluded that much of the rain and verdure of central Europe and England is due to the vapour coming to those regions from the heart of the African desert. The relative conditions over Europe and the desert are chronically similar to those which characterised the weather of Europe and South America during 1911.

If the semi-annual exchange of vapour between the hemispheres really took place, as suggested by Dr. Ramsauer, it would probably cause disaster throughout the northern half of the world during periods of diminished ultra-violet radiation. For while the southern hemisphere might easily accommodate the vapour emanating from the limited water surfaces during the northern summer, six months later, with the boundless southern oceans seething under the perihelion sun, the quantity of vapour sent across the equator would quickly impart a decidedly martian aspect to the northern hemisphere.

In discussions of summer weather, an important physical fact is generally overlooked, one which is rarely referred to with proper stress even in treatises on meteorology, viz. the remarkable increase in the tension of saturated aqueous vapour after passing the temperature of 30° C. The energy of solar rays falling upon the ocean surfaces, the chief source of vapour supply, is almost wholly used up in converting the water into a gaseous state, so that the temperature of the water surface varies but slightly during a season; whereas the energy of the rays falling on land areas is chiefly exhausted in heating the soil and dust particles suspended in the air, and thus indirectly heating the air in contact with those solid bodies and causing land temperatures in the lower atmosphere to vary through wide limits. So, while the ocean gives off a nearly constant supply of vapour at a uniform and relatively low temperature during the summer, the so-called capacity of the continental air for vapour increases enormously once the midsummer temperatures are reached, making it increasingly difficult for atmospheric overturnings to bring about condensation unless rains have been sufficiently distributed over the land during the late spring and early summer to compensate for this large saturation deficit which would otherwise be caused by intense solstitial insolation.

This relation between temperature and vapour tension sufficiently explains the barren islands of tropical mid-oceans, as well as the clear skies and "dry spells" of the great majority of summers; and it also points to the red end as the portion of the solar spectrum chiefly responsible for "the weather of 1911."

I have no desire to question the statement that ultra-violet rays do produce condensation nuclei; the portion of Dr. Ramsauer's first letter which struck me as open to debate is the statement that ultra-violet solar radiation is the *chief source* of condensation nuclei in the atmosphere. One of the ablest investigators of the day has recently said, in treating of another branch of terrestrial physics, "it is in any case to observation that we must turn as the touchstone by which to try theory." During the past nine years I have made many observations of the relative intensity of ultra-violet solar radiation in the northern hemisphere, on the ocean, and in the southern hemisphere, with the hope of witnessing some phenomenon in nature that might furnish evidence of this power of ultra-violet rays so conclusive as the results obtained in laboratory experiments. Only once have I had reason to think (for a short time) that my efforts were being rewarded.

Although Dr. Ramsauer concludes that ultra-violet solar radiation was at a minimum phase during 1911, during the first half of March of that year I obtained the highest values for all the years of my measurements. About 10 a.m., March 11, just after the highest maximum had been recorded, a surprisingly sudden decrease in intensity was indicated by the actinometer; no cause for the change was discernible in the deep blue of a perfectly clear sky, and observations were repeated as rapidly as possible until 10.45 a.m., when the intensity had become very weak and filmy clouds could be seen in the zenith in an incipient stage of formation; by 11.30 the whole sky was overcast with an alto-stratus formation. During this time no change was registered in the brisk, warm, northerly wind which had been blowing since early morning, and the pressure, though slightly below normal, showed the normal variation for this time of day; so it seemed that the ultra-violet rays had at last displayed their powers in an unquestionable manner. But after the upward turn in the diurnal pressure curve set in, about 2 p.m., the barometer rose at an unusual rate, and by sunset a strong, cold, southerly wind was blowing, thus showing that the transformations in the upper air of the forenoon were due to the advance portion of a pressure wedge overflowing the warm and relatively moist surface current. It may be added here that no rain fell anywhere near the place of observation for several weeks after this display (although March is still well within the rainy season of this region), nor have I, up to the present time, heard of such general and heavy rains over the earth during the latter part of the month as would commensurate with such unusual activity in the ultra-violet field of the sun.

Dr. Ramsauer may claim that the mere fact of condensation is sufficient proof of his theory, and this brings up another matter referred to in his first letter which I shall discuss briefly. He says:—"If we neglect the purely local formation of nuclei in large centres of industry, the ultra-violet . . . radiation of the sun is chiefly responsible," &c., implying that condensation can take place only on an infinitely small number of the solid impurities sustained in the air. There are probably not so many factory chimneys on the whole continent of South America as there are in London, yet within the past few days an area of several hundred thousand square miles in the central section of this continent was covered by a shallow fog caused by dust particles, raised by the high winds of a "dry cyclone," cooling by radiation into the calm air of a rapidly following high-pressure area. This is only a single instance of a phenomenon which is very common indeed during the fall and winter in all regions of the temperate zones, and it goes to show that clean dust particles raised by the winds from virgin soils are quite as effective as condensation nuclei as the particles of waste products which escape through the chimneys of manufacturing towns. If dust particles can act so efficiently as nuclei in the low-lying strata, why should they be denied this agency when they appear in the higher regions of the atmosphere? For their existence in those regions, even far out into interplanetary space, is impressively evidenced by the brilliancy of the twilight glow, the meteor tracks, and the zodiacal light.

L. G. Schultz.

Oficina Meteorológica Argentina, Observatorio
Magnético, Pilar, Córdoba, July 26.

Antiquity of Neolithic Man.

Recent excavations in St. Helier, Jersey, have brought to light the following evidence bearing on the antiquity of Neolithic man:—

The soil beneath the town of St. Helier is, in descending order, composed as follows:—

(1) A deposit of blown sand and recent alluvium from 4 ft. to 6 ft. thick.

(2) A bed of brown sandy and clayey peat (with relics of Gallo-Roman times).

(3) A marine deposit, consisting of clay, shingle, and shell-gravel, from 2 ft. to 5 ft. thick.

(4) A bed of firm black peat and forest remains which ranges from 5 ft. to 14 ft. in thickness.

This peat and forest bed is traceable to the shore, where it forms the well-known "submerged forest," thence (as revealed by the dredge) across the channel that separates the island from the continent, and along the continental coast from Cape La Hague to Finisterre.

This no doubt is all one with the post-glacial submerged forests of the British Isles and north-western Europe in general, for all through the flora and fauna are the same, viz. oak, alder, birch, hazel, Juncus, and Equisetum, with hazel nuts in profusion. *Bos longifrons*, red deer, and wolf, even elytra of the little purplish-green beetle, *Geotropus vernalis*, are present in this layer beneath St. Helier, as they are from extreme north to south throughout the vast forest area.

This deposit, then, marks the period of the commencement of land elevation which followed the subsidence of glacial times, for it lies immediately upon unmistakable rubble-drift and blue marine clay.

Neolithic relics, in the way of stone implements and fragments of pottery, are very plentiful on the surface, and in the upper levels, of this forest bed, but, so far as I can ascertain, have never been recorded from the strata beneath.

In a series of excavations now in progress for the foundations of a building in St. Helier, the strata as above described have been cut through, and in the blue clay *beneath the forest bed* (which here is 8 ft. thick) were found Neolithic implements as follows:—(1) A squared block of diorite about 6 in. in width and in breadth, and about 2 in. thick, which has been used as an anvil, apparently for chipping flints. It is deeply scored on both sides. (2) A flat sandstone pebble about 4 in. in diameter, which has been used in the same way. (3) A flat pebble of dolerite about a foot in length, 4 in. wide at one end, and running to a point at the other.

This pebble has served three purposes, for it is worn and abraded on the broad and fairly sharp end, showing that it has been used as an axe; again, on the sharpest lateral edge, indicating use as an ordinary meat-chopper; finally, it is scored with many cuts on the flat surfaces, having apparently been used as an anvil for chipping flints. (4) Two good specimens of the very typical flat pebble implements of elongated triangular form, bevelled at the broad end—a crude form of implement which has persisted until the dolmen period, and occurs plentifully amongst the latest Neolithic relics.

Besides these there were numerous flint chippings, cores from which flakes had been struck, and some crude flint implements with no characteristic detail.

In the same stratum as these, and in a layer of yellow clay which lies beneath, flint implements of decided Chellian, Acheulian, and Mousterian types are frequent, but the relics above specified are very clearly and decidedly Neolithic.

As the portion of the forest bed at this spot must represent the vegetation that first fringed the land as it recovered from the depression of glacial times, and these relics lie beneath it, we cannot but conclude that the Neolithic races date from a period far more remote than has usually been assigned to them, and that they must, in fact, date back nearly into the last glacial period.

Question may arise as to the possibility of a disturbance of the area by floods or other agencies, and